6.2.2 Alternative Plans

Alternative airport layout plans are considered as shown in Figs. 6-5, 6-6, 6-7, and 6-8 for Plan A of Frontal Linear Concept, Plan B of Pier Concept, Plan C of Pier Concept and Plan D of Frontal Concept respectively.

Among these plans, Plan A is recommended for the following reasons:

a. The Plan A takes into consideration the future expansion of the Airport for the long-term plan beyond the year 2000.

b. The terminal concept of the Plan A has advantages over other plans in terms of expansibility of apron and terminal building, flexibility to accommodate bigger aircraft and baggage handlings, etc. as shown in Table 6-1.

6.2.3 Terminal Area Layout Plan

The terminal area layout plan based on Plan A is made as shown in Fig.6-9 based on the following considerations:

a. The air traffic control tower is planned to be located at the centre of the administration area on the line of the middle point of the first runway, where the end of the second runway can be observed at the eye level of about 30m and the transitional surface will be preserved.

b. The administration area is planned to comprise the administration buildings of the Airport Authority and the airlines, the guard facility, the CIQ staff building, the pilots and crew rooms as well as the tower, with due regards for the expansion of the area.

c. The cargo terminal building is planned to be located adjacent to the north side of the passenger terminal building and near the loading apron, because only belly air cargoes are expected at the year 2000.

d. The aircraft maintenance area is planned to be located at the northern part of the Airport,considering the merit of using the maintenance spots also as the night stay spots and the expansibility for the long-term plan.

e. The utility facilities are planned to be located at the gravity centre of the Airport, with due regards for the supply to the airport facilities including those of the long-term plan.

f. The drainage and sewage disposal facilities are planned to be located at the places where the discharge to the Fuhe River is facilitated.

g. The POL facility is planned to be located near the loading apron and at the northern part of the Airport suitable for the supply of aircraft fuel.

h. The staff housing area is planned to be located at a due distance both to the first runway and to the access road.

6.2.4 Overall Airport Layout Plan

Fig. 6-10 shows the Overall Layout Plan of the Airport Facilities for the design year of 2000, which preliminary design and cost estimation in the following Chapters are to be based on.

The Chinese side has its own overall layout plan a little different from the recommended one as shown in Fig. 6-11 for reference.

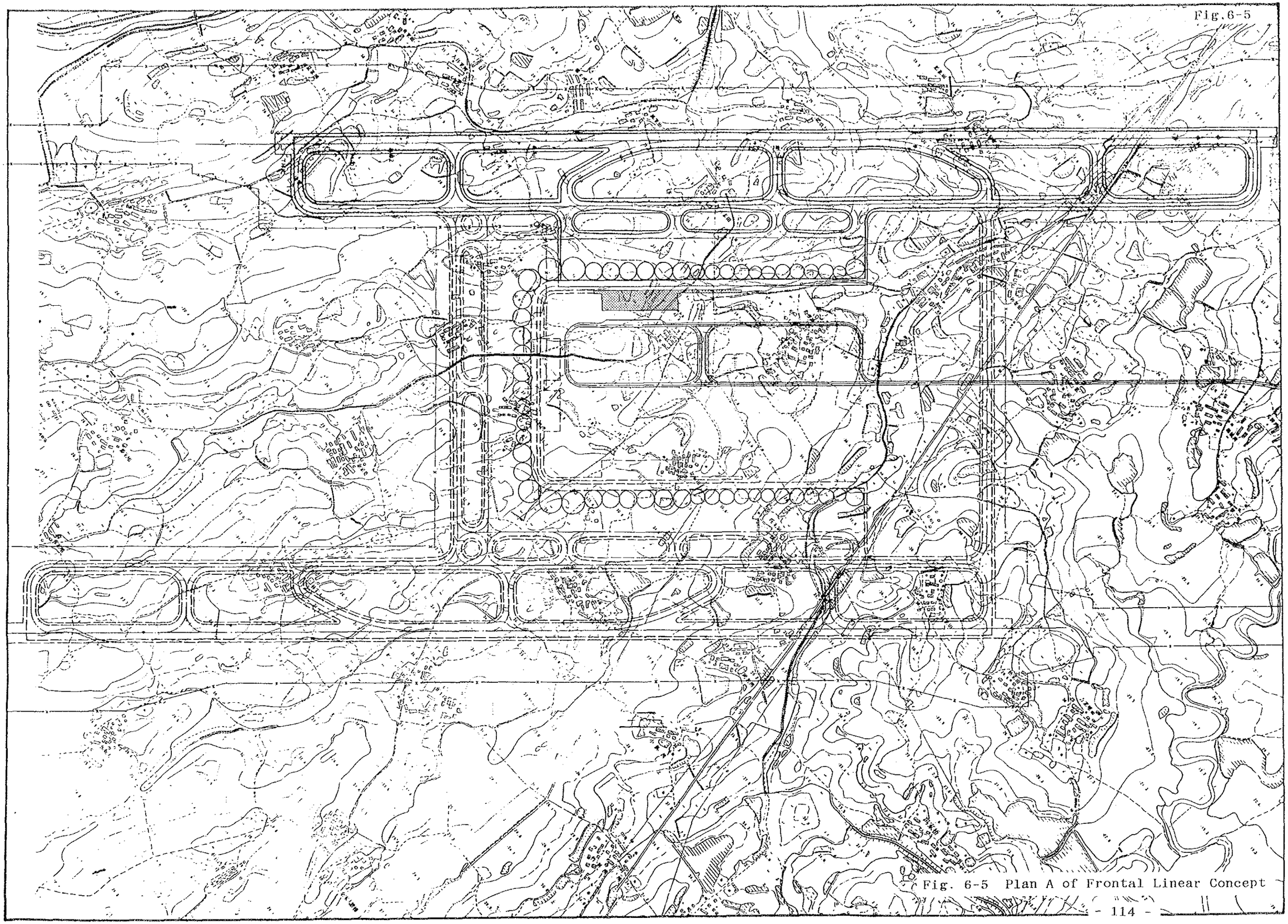


Fig. 6-5 Plan A of Frontal Linear Concept

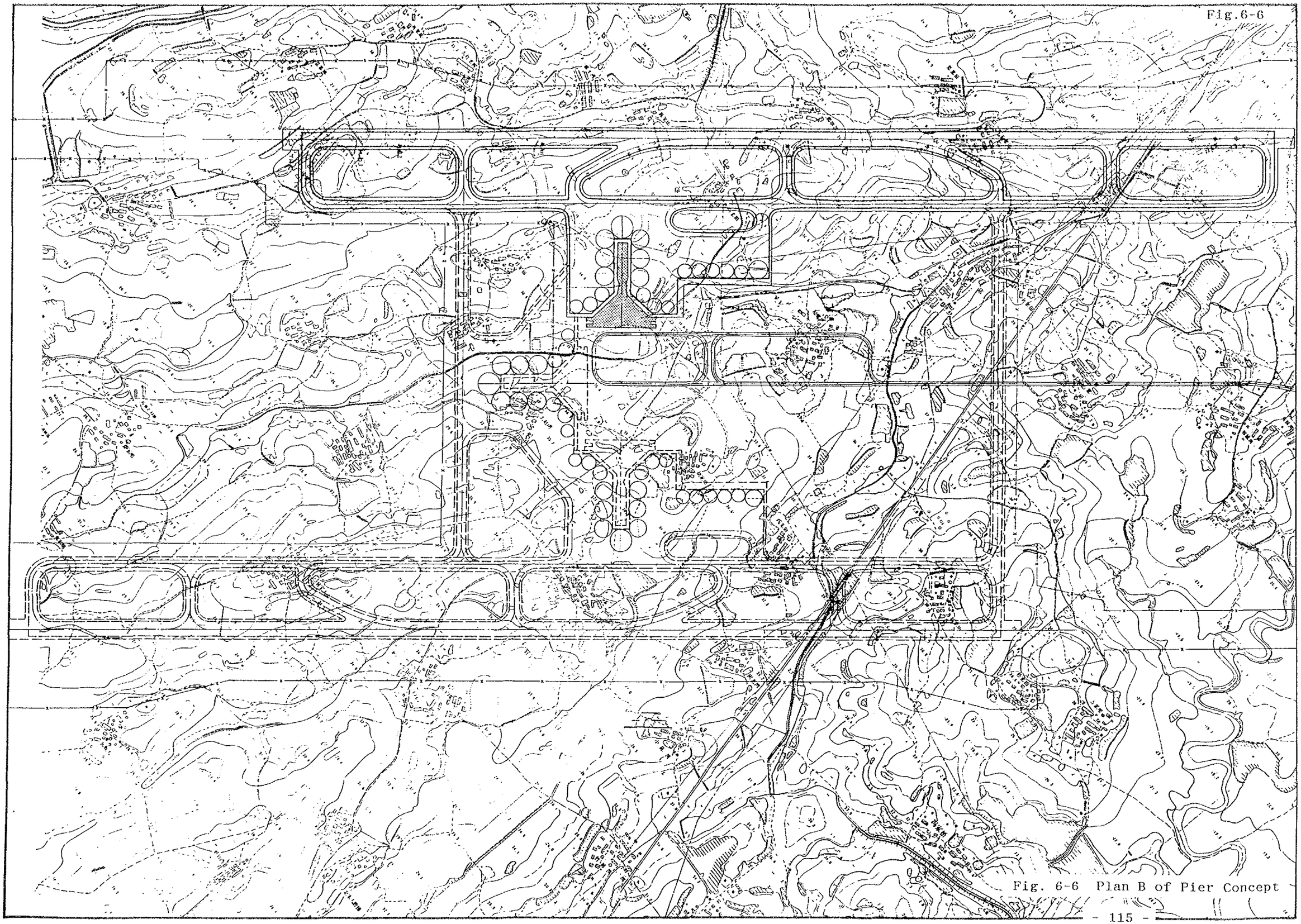


Fig. 6-6 Plan B of Pier Concept

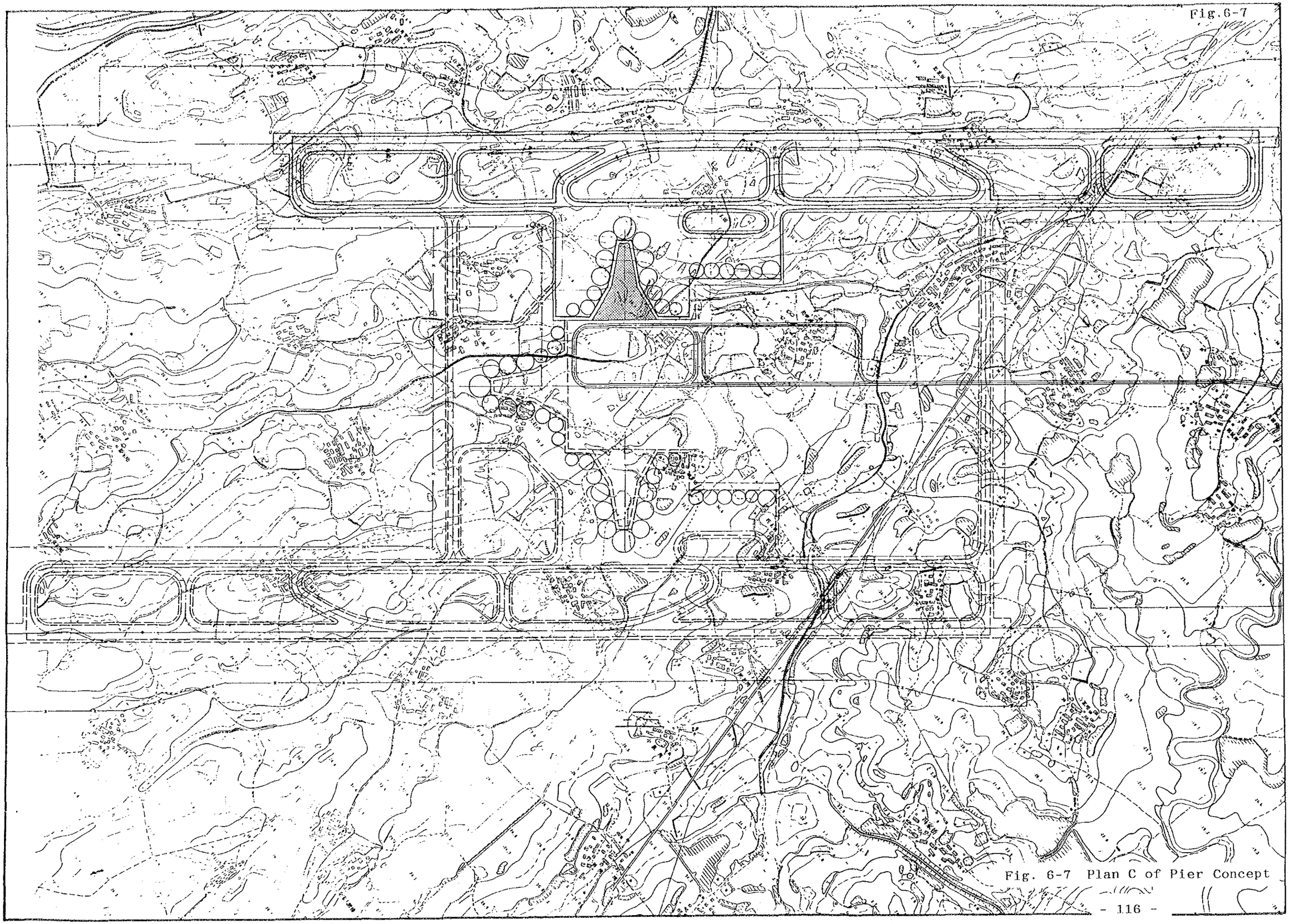


Fig. 6-7 Plan C of Pier Concept

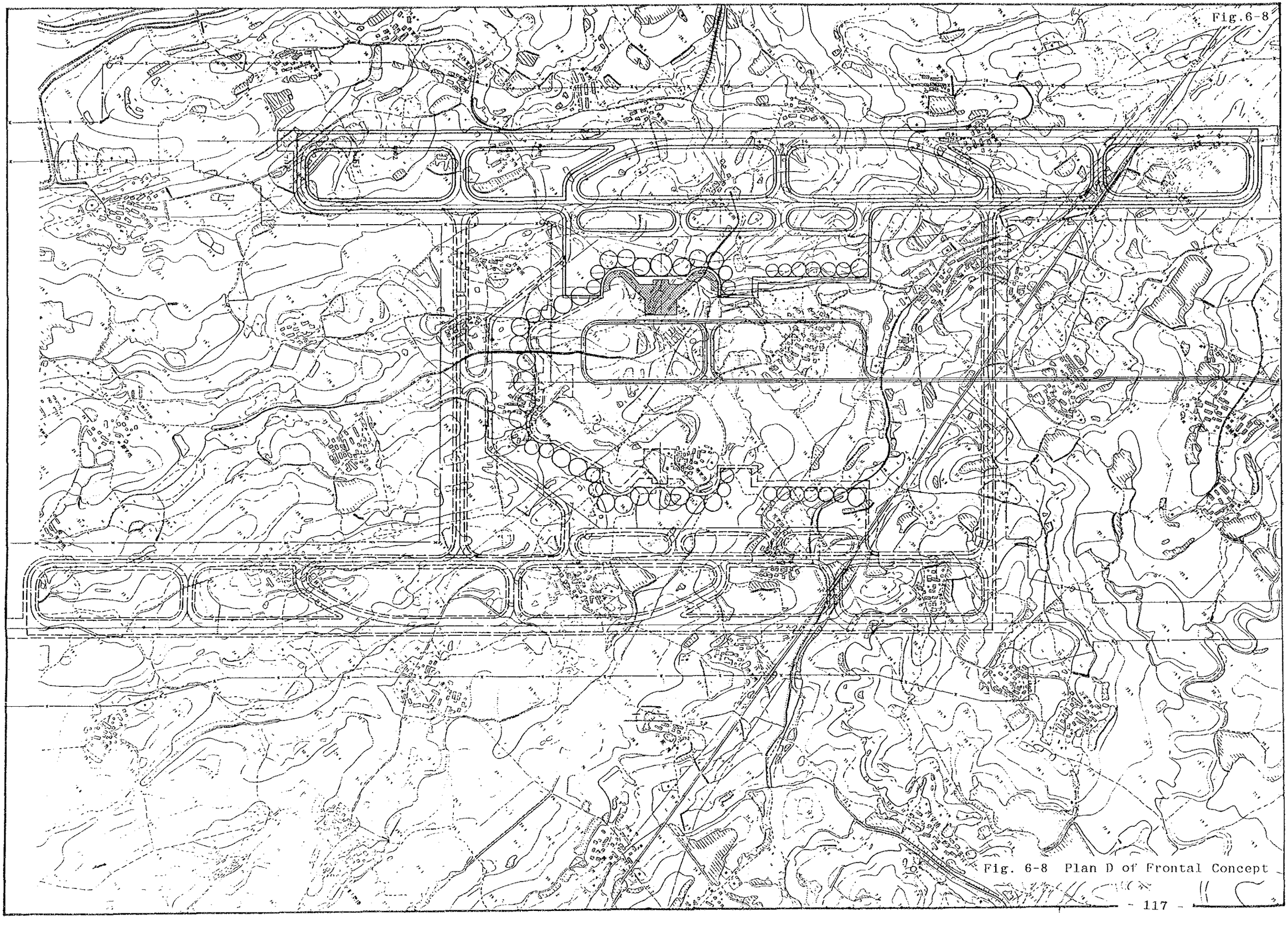
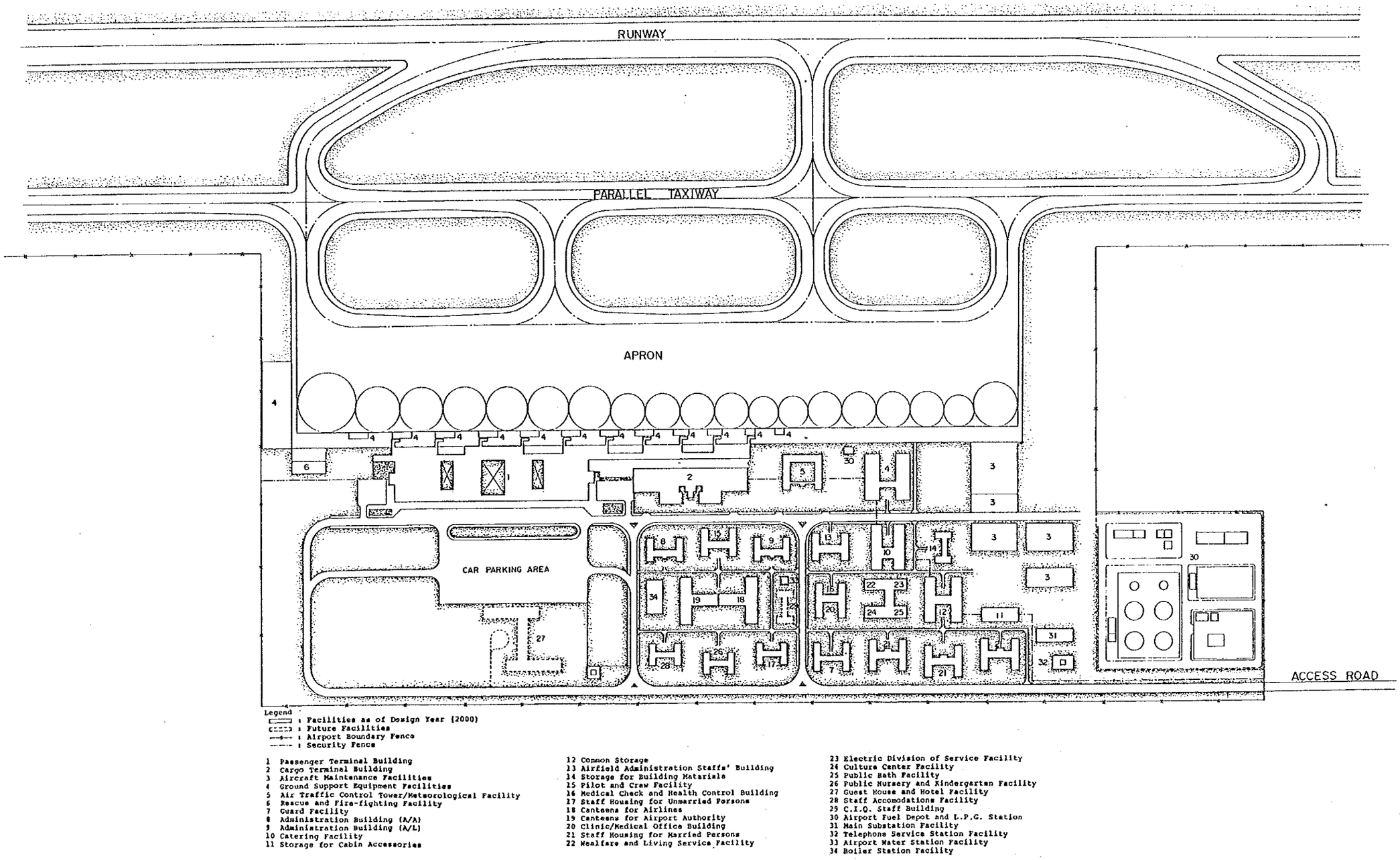


Fig. 6-8 Plan D of Frontal Concept



Legend
: Facilities as of Design Year (2000)
: Future Facilities
: Airport Boundary Fence
: Security Fence

1 Passenger Terminal Building
2 Cargo Terminal Building
3 Aircraft Maintenance Facilities
4 Ground Support Equipment Facilities
5 Air Traffic Control Tower/Meteorological Facility
6 Rescue and Fire-fighting Facility
7 Guard Facility
8 Administration Building (A/A)
9 Administration Building (A/L)
10 Catering Facility
11 Storage for Cabin Accessories
12 Common Storage
13 Airfield Administration Staffs' Building
14 Storage for Building Materials
15 Pilot and Crew Facility
16 Medical Check and Health Control Building
17 Staff Housing for Unmarried Persons
18 Canteens for Airlines
19 Canteens for Airport Authority
20 Clinic/Medical Office Building
21 Staff Housing for Married Persons
22 Welfare and Living Service Facility
23 Electric Division of Service Facility
24 Culture Center Facility
25 Public Bath Facility
26 Public Nursery and Kindergartan Facility
27 Guest House and Hotel Facility
28 Staff Accomodations Facility
29 C.I.Q. Staff Building
30 Airport Fuel Depot and L.P.G. Station
31 Main Substation Facility
32 Telephone Service Station Facility
33 Airport Water Station Facility
34 Boiler Station Facility

Fig.6-9 Terminal Area Layout Plan Scale 1:5000

PEOPLE'S REPUBLIC OF CHINA / FEASIBILITY STUDY ON THE CONSTRUCTION PROJECT OF WUHAN/TIANHE AIRPORT TERMINAL AREA LAYOUT PLAN Scale 1 : 5000
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) MAR. 1990 A - 0

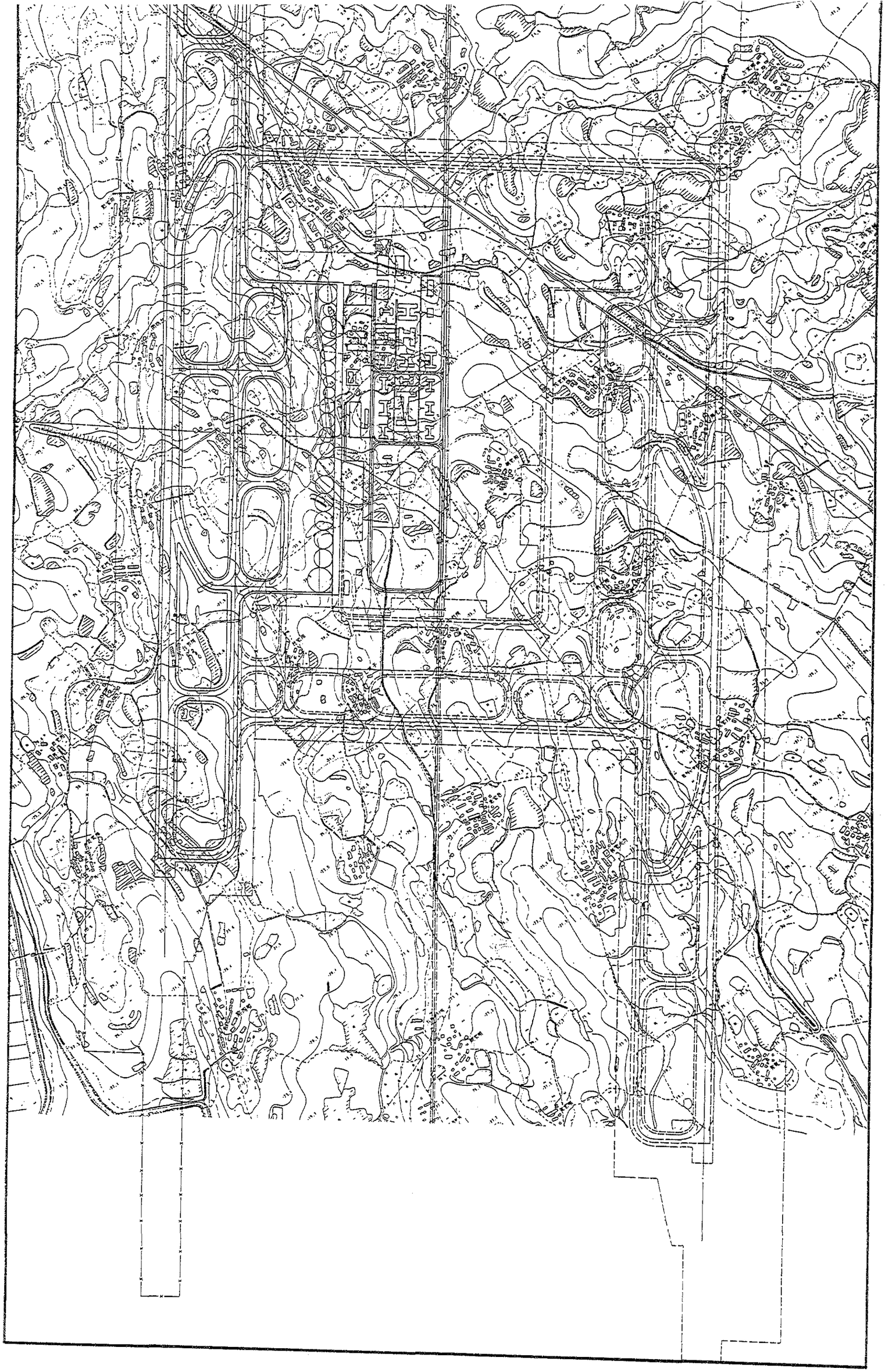


Fig.6-10

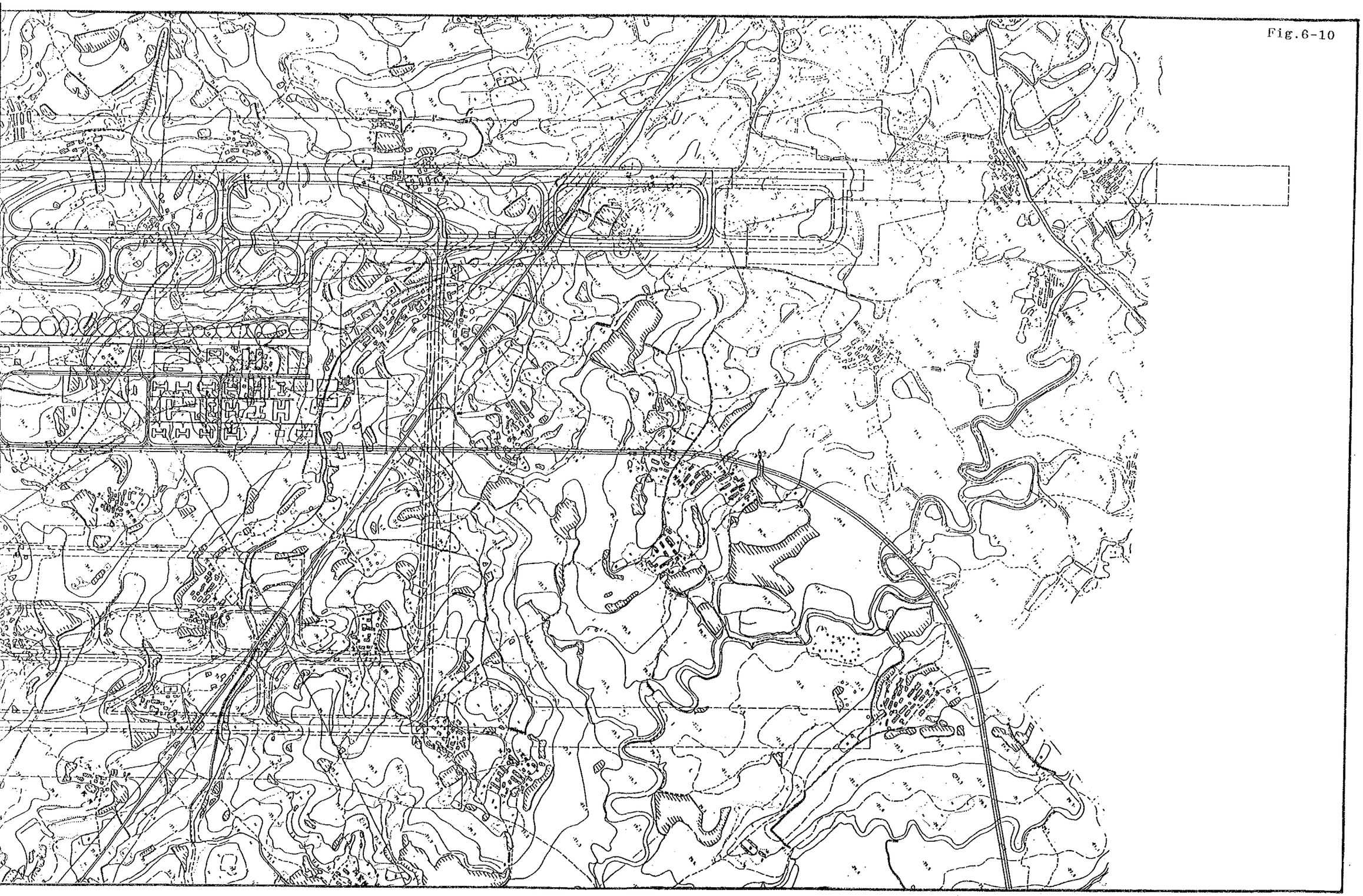


Fig.6-10 Overall Layout Plan of Airport Facilities

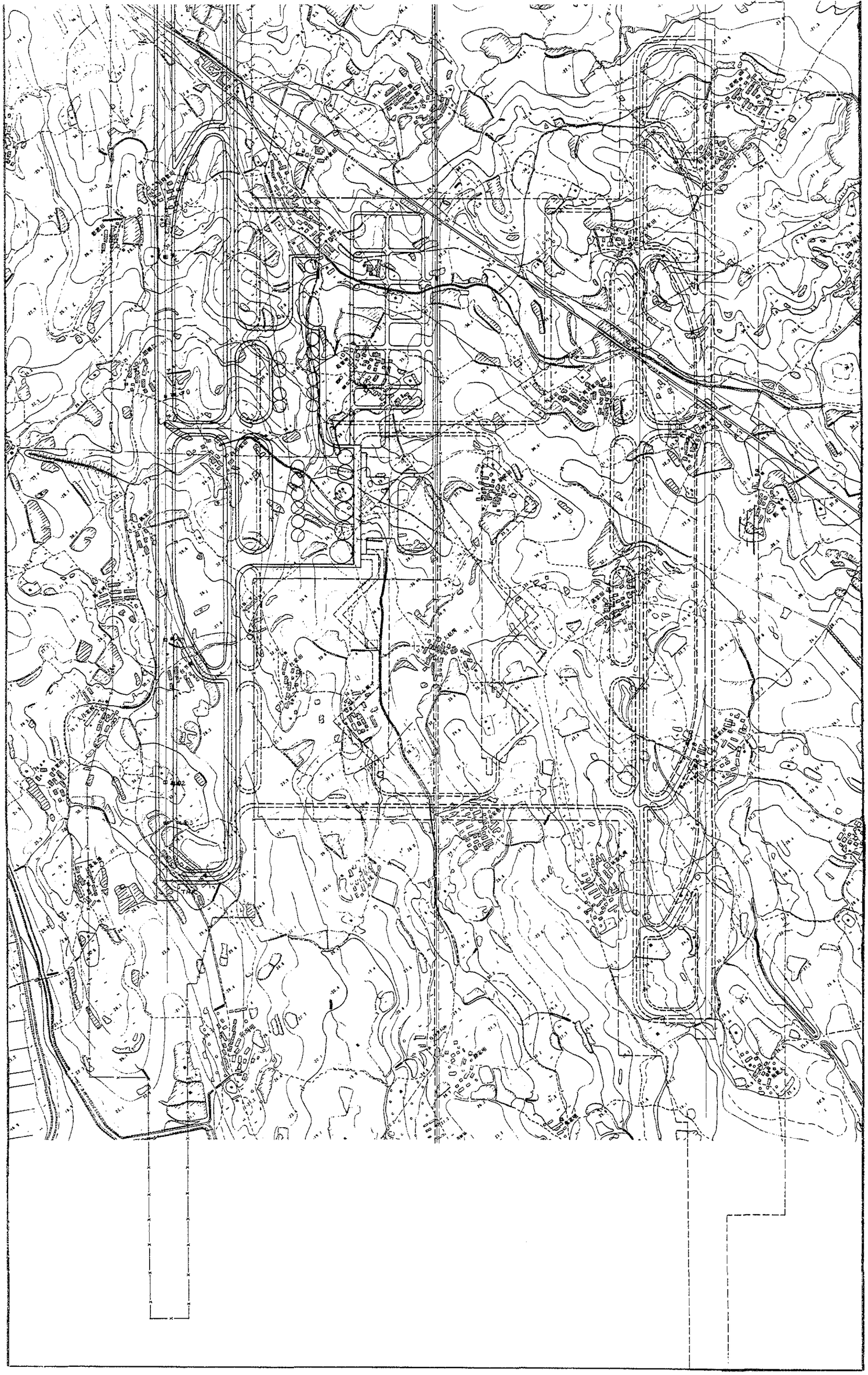


Fig.6-11 Reference: Layout Plan made by C.A.A.C.

CHAPTER 7 PRELIMINARY DESIGN

CHAPTER 7 PRELIMINARY DESIGN

7.1 General

In accordance with the facility requirements and conditions as established in Chapter 5, preliminary design is made on Wuhan/Tianhe Airport with the design year of 2000.

7.2 Airfield Facilities

The preliminary design of airfield facilities is made based on the following design conditions, with the layout plans as shown in Fig.7-1 and Appendix 7-1.

7.2.1 Runway

(1) Dimensions

Dimensions of the runway are determined as follows:

a. Runway length: 3,000 m
b. Runway width: 45 m
c. Shoulder width: 7.5 m on each side of the runway.
d. Stopway length: 60 m on each end of the runway.
e. Runway strip length: 3,120 m including the stopway length of 120 m.
f. Runway strip width: 150m on each side of the centre line of the runway and its extended centre line throughout of the length of the strip.

(2) Slopes

1) Longitudinal slope

The longitudinal slope of the runway is determined based on the study on the balance of earth work volumes as shown in Appendix 6-5.

2) Transverse slope

The transversal slope of 1% is determined at normal portions except at an intersection with the taxiway, considering the quick run-off of rain water, as shown in Appendix 7-1(2).

(3) Pavement structure

The pavement structure of the runway is determined based on the following conditions, with the details as shown in Appendices 7-1(3) and (4):

a. Design aircraft type: B-767 for scheduled flight, and B-747 for non-scheduled flight.

b. Subgrade strength: 4 kg/cm^3 determined on the basis on the soil classification of the Chinese road design manual, as shown in Appendix 7-2.

c. Flexural strength of concrete: 45 kg/cm^2 determined on the basis of pavement construction works done in Wuhan City.

d. Equivalent annual departures by design aircraft: 9,800 computed by the F.A.A. method.

e. Pavement area: To be divided into critical area and non-critical area according to the FAA Standard.

As a result, the followings are determined

1) Sub-base thickness: 30 cm

2) Concrete slab thickness:
   - In critical area: 40 cm
   - In non-critical area: 28 cm (0.7h)
   - In shoulders: 20 cm (0.5h)

The above determined pavement structure is sufficient for the non-scheduled operation of B-747 aircraft with the safety factor of 1.88.

7.2.2 Taxiway

(1) Number of taxiways

The following number of taxiways are planned based on the taxiway configuration as determined in Chapter 5.

- One parallel taxiway;
- Two entrance taxiways;
- Two rapid exit taxiways;
- Three right-angled exit taxiways;
- One apron taxiway; and
- Three connecting taxiways between the parallel taxiway and the apron taxiway.

(2) Width

The width of the taxiways in straight portions is determined at 23 m as mentioned in Chapter 5.

(3) Taxiway shoulder

The taxiway shoulders are extended symmetrically on each side of the taxiways on straight portions with the width of 10.5 m each.

(4) Rapid exit taxiway

The dimensions of rapid exit taxiways are determined on the basis of the ICAO Design Manual as shown in Appendix 7-1(5).

(5) Fillets

The dimensions of fillets are determined based on the Japanese Design Standard enabling B-747 type aircraft to pass, as shown in Appendices 7-1(6) to (9).

(6) Slopes

The longitudinal slope is determined at 0.18% on the parallel taxiways and at maximum 1.0% on other taxiways.

The transversal slope of 1% is determined at normal portions except at an intersection with the taxiway, considering the quick run-off of rain water.

(7) Pavement structure

The pavement structure of taxiways is shown in Appendices 7-1(3) and (4) with the same design conditions as those for runways. The thickness of concrete slab is determined at 36 cm (0.9h) in exit taxiways according to the FAA Standard.

7.2.3 Apron

(1) Separation from the parallel taxiway

The distance between the centrelines of the parallel taxiway and the apron taxiway is determined at 159 m, which will make it possible to provide additional aircraft stands for remote positions as shown in Fig.7-2.

(2) Width

The total width of the apron is determined at 952 m based on the number and the width of the aircraft stands as discussed in Chapter 5.

(3) Depth

The depth of the apron defined as the distance from the apron taxiway centreline to the apron edge is determined at 133 m so as to ensure a minimum clearance recommended be ICAO, as shown in Fig.7-2.

(4) Slope

The slope of the apron is determined at 0.5% so as to keep standing aircraft stable and prevent accumulation of rain water based on the the Japanese Design Standard.

(5) GSE pass

A pass for GSE is provided in front of the apron with the width of 20 m according to the Japanese Design Standard, as shown in Fig.7-2.

(6) Pavement structure

The pavement structure of the apron is determined based on the same design conditions as those for the runway with the thickness of concrete slab of 40 cm, as shown in Appendices 7-1(3) and (4). However, the pavement of the GSE pass is determined with the thickness of 24 cm based on the following conditions of design load for a towing tractor:

- Gross weight: 50 tons
- Type of wheel: Single wheel
- Tyre pressure: 6.8 kg/cm^2
- Tyre pressing area: 1,810 cm^2

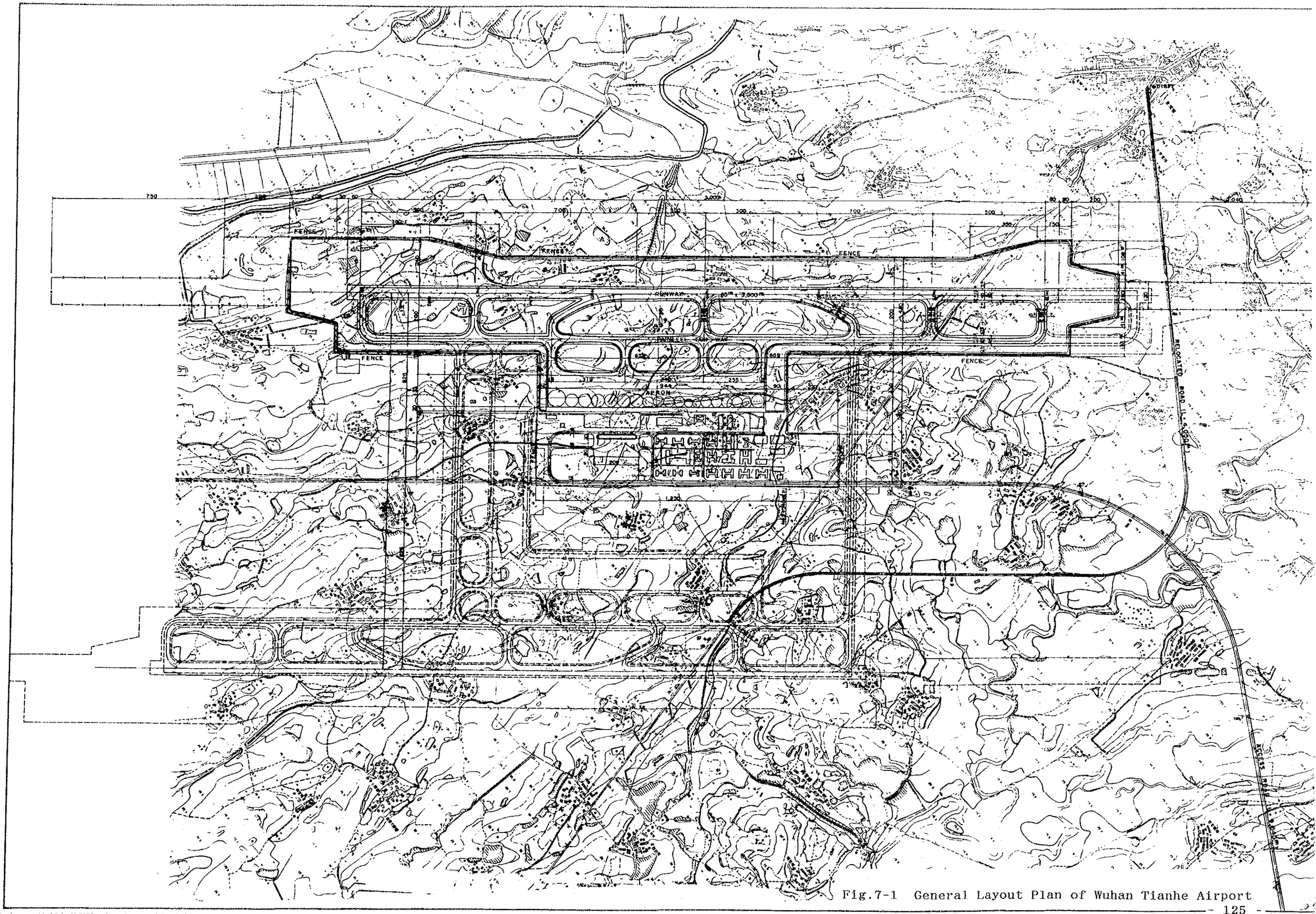


Fig.7-1 General Layout Plan of Wuhan Tianhe Airport

Fig.7-1

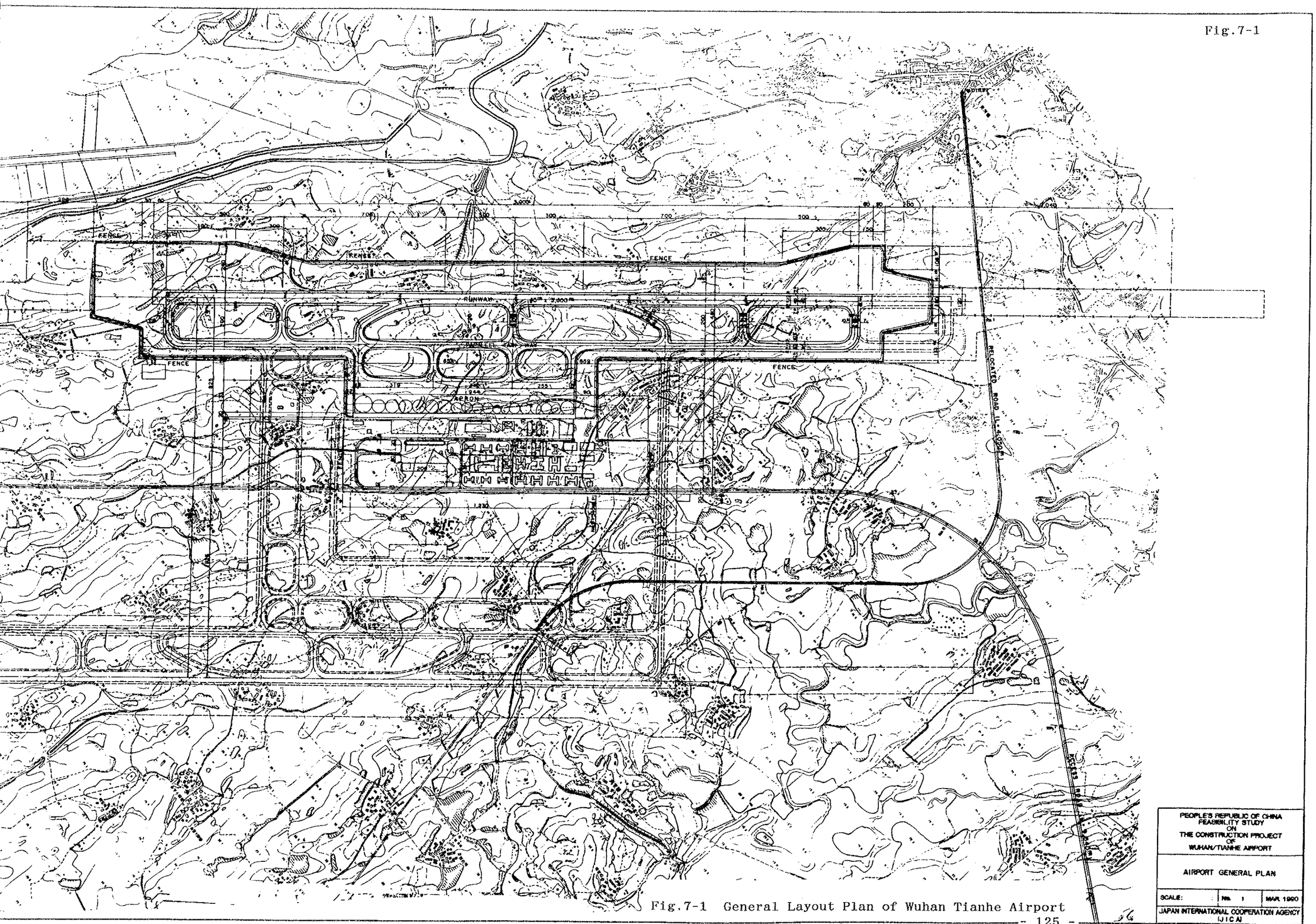


Fig.7-1 General Layout Plan of Wuhan Tianhe Airport

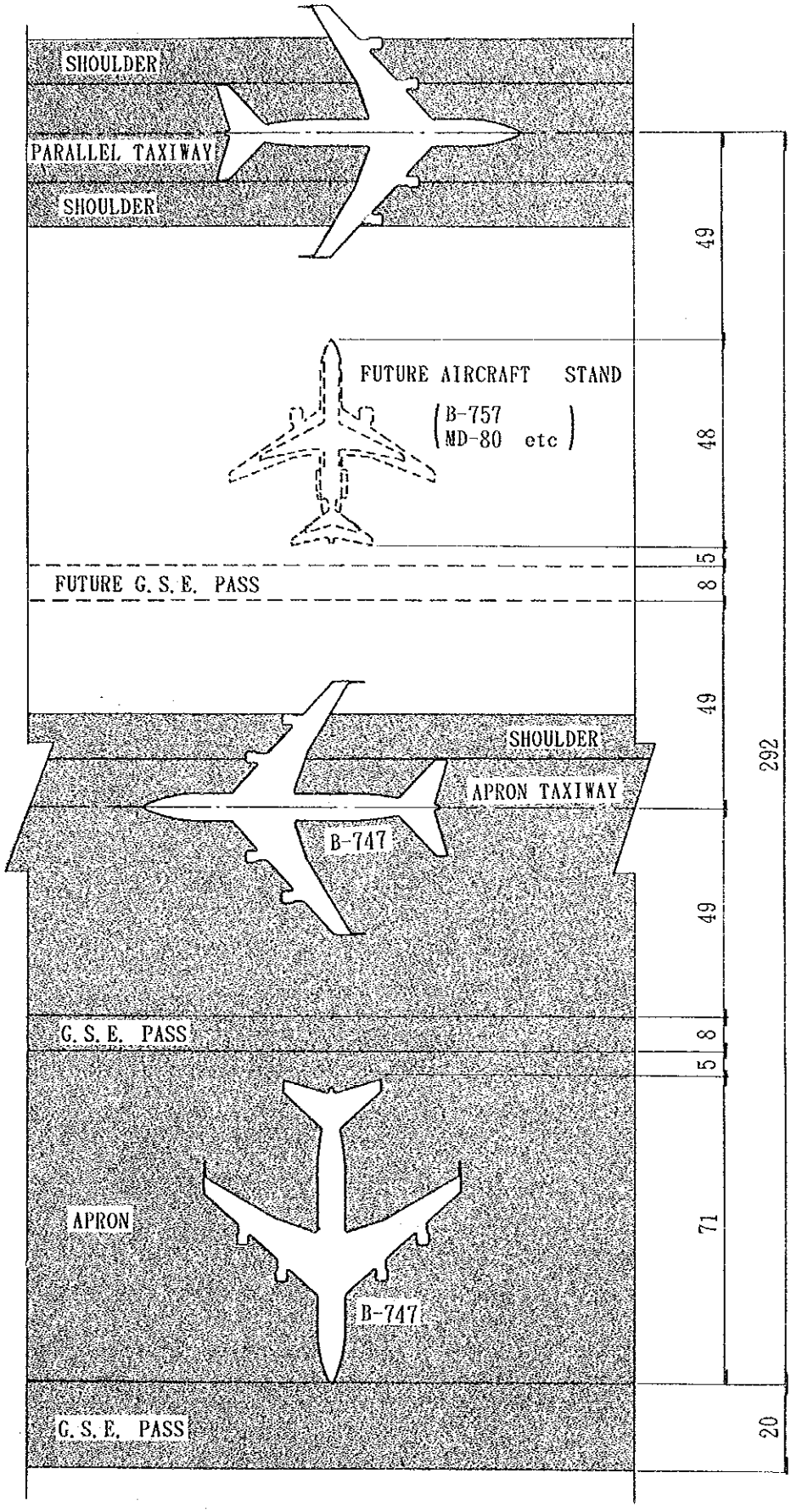


Fig.7-2 Distance from Parallel Taxiway to Apron Edge

7.3 Terminal Facilities

7.3.1 Passenger Terminal Building

The basic concepts for the preliminary design of passenger terminal buildings are summarized as follows;

- Linear frontal concept;
- One-and-a-half-level concept;
- Straight flow of passenger processing;
- Combined operations for domestic and regional routes;
- Separated operations for departures and arrivals at the curbside; and
- Sufficient flexibility and expansibility for growth.

Based on the above concepts, the design conditions for passenger terminal buildings are determined as follows, with the floor plans and elevations as shown in Appendix 7-3:

a. Building area: 13,700 m^2 excluding portions under the canopy.

b. Floor area
   - First floor: 10,150 m^2
   - Second floor: 13,700 m^2
   - Third floor: 3,450 m^2

c. Total floor area: 27,300 m^2

d. Structure: Three stories of reinforced concrete.

e. Exterior finishing
   - Roof: Flat roof with asphalt waterproofing and walkable clinker tile finishing
   - Wall: Mosaic tile
   - Fittings: Aluminum sash
   - Window and glass: Glass block and polished glass

f. Interior finishing
   - First floor for passenger use
     - Floor: Porcelain tile
     - Wall: Emulsion paint
     - Ceiling: Gypsum board
   - Second floor for passenger use
     - Floor: Vinyl floor tile
     - Wall: Emulsion paint
     - Ceiling: Gypsum board
   - Offices
     - Floor: Vinyl floor tile
     - Wall: Emulsion paint
     - Ceiling: Gypsum board

g. Special equipment to be installed
   - Passenger boarding bridge: 10 sets
   - Departure baggage conveyor: 3 sets
   - Arrival race track conveyor: 3 sets
   - X-ray baggage inspection system: 3 sets
   - X-ray hand baggage inspection system: 6 sets

- X-ray passenger inspection system:	6 sets (of gate type)
- Visual sign for departure and arrival public use:	1 set
- Flight indicator for departure and arrival	
- Main board (Dept./Arrival)	1 set (10 lines each)
- Gate board:	10 sets (1 line each)
- Baggage board:	3 sets
- Neon sign for airside and curbside:	1 set
- Elevator:	3 sets
- Escalator:	4 sets
- Moving sidewalk:	4 sets
- Counter	
- Check-in counter:	17 sets
- Reservation and ticketing counter:	5 sets
- Departure customs counter:	1 set
- Security inspection booth:	6 sets
- Departure immigration counter:	3 sets
- Arrival quarantine counter:	1 set
- Arrival immigration counter:	4 sets
- Arrival customs counter:	1 set

7.3.2 Cargo Terminal Building

The basic concepts for the preliminary design of cargo terminal buildings are summarized as follows:

- Sufficient flexibility and expansibility for growth;
- Combined operations for domestic and regional routes; and
- Capability of stage construction.

Based on the above concepts, the design conditions for cargo terminal buildings are determined as follows, with the floor plans and elevations as shown in Appendix 7-4:

a. Building area: 4,500 m^2
   - Domestic block: 3,880 m^2
   - Regional block: 620 m^2

b. Total Floor Area: 4,500 m^2

c. Structure: One story of reinforced concrete

d. Exterior finishing
   - Roof: Flat roof with unwalkable asphalt waterproofing
   - Wall: Exposed concrete finishing with acrylic-urethane resin paint
   - Fittings: Aluminum sash and steel shutter with oil paint
   - Window and glass: Glass block and polished glass

e. Interior finishing
   - Cargo sorting area
     - Floor: Concrete with trowel and hardener
     - Wall: Exposed concrete finishing with emulsion paint
     - Ceiling: Gypsum board
   - Office
     - Floor: Vinyl floor tile
     - Wall: Mortar with emulsion paint
     - Ceiling: Gypsum board

7.3.3 Aircraft Maintenance Facility

The design conditions for aircraft maintenance facilities excluding Docks with instrument and machines are determined based on the facility requirements described in Chapter 5, as shown in the following, with the plans as shown in Appendix 7-5.

a. Floor area of hangar building
   - First floor area: 5,500 m^2
   - Second floor area: 1,500 m^2
   - Third floor area: 1,350 m^2
   - Fourth floor area: 800 m^2
   - Total floor area: 9,200 m^2

b. Structure: Four stories of reinforced concrete and steel truss

c. Exterior finishing
   - Roof: Coloured steel sheet
   - Wall: Exposed concrete finishing with acrylic-urethane resin paint
   - Fittings: Steel sash with oil paint
   - Hangar door: Steel plate with oil paint

d. Interior finishing
   - Hangar floor: Concrete with trowel and hardener
   - Wall: Exposed concrete finishing with emulsion paint
   - Ceiling: Exposed steel truss with oil paint

7.3.4 Ground Support Equipment and Facility

The types and number of ground support equipment and the minimum required number of sets are planned as shown in Table 7-1, based on the peak hour traffic and the required aircraft stands by aircraft type, considering effective utilization of equipment.

Table 7-1 List of Ground Support Equipment

GSE Type	Number for Each Set		
	B-767 class	B-737 class	B-747
Tow Tractor(for Aricraft)	1	1	1
Tow Bar	1	1	1
Ground Power Unit	1	1	2
Air Start Unit	1	1	2
Lavatory Truck	2	1	2
Water Truck	1	1	1
Cabin Cleaning Truck	2	1	2
Passenger Step	2	1	2
Cargo Loader	2	-	2
Belt Loader	2	1	2
Catering Truck	1	1	2
Tow Tractor(for Dolly)	2	2	2
Container Dolly	20	-	24
Pallet Dolly	2	-	4
Baggage Trailer	-	4	-
Air Conditioning Truck	1	1	2
Required Number of Set	3	1	1
Follow Me Car		1 in total	
Ramp Bus		2 in total	

The design conditions for GSE garage are determined as follows:

a. Floor area: approximately 2,000 m^2

b. Structure: One story of reinforced concrete

c. Exterior finishing
   - Roof: Asphalt waterproofing, unwalkable
   - Wall: Exposed concrete finishing with acrylic-urethane resin paint
   - Fittings: Steel sash and steel shutter with oil paint

d. Interior finishing
   - Floor: Concrete with trowel and hardener
   - Wall: Exposed concrete finishing with emulsion paint
   - Ceiling: Gypsum board

7.3.5 Roads and Car Park

(1) Layout

The layout of the roads and car park is made based on the facility requirements described in Chapter 5 and the layout of the passenger terminal building and related buildings as shown in Fig.6-9. The roads are designed for one-way counterclockwise traffic in the public terminal area and two-way traffic in the operational area as shown in Fig.7-4.

The car park is placed in front of the passenger terminal building with two entrances and two exits as shown in Fig.7-4 together with the sidewalks.

(2) Dimensions

a. Width of roads: 8 m
b. Size of car park: 200 m x 80 m
c. Width of sidewalk: 3 m

(3) Transverse slope

1% in typical sections

(4) Pavement

The pavement of the roads and car park is designed with the same pavement structure as that of Dai Huang Road as shown in Fig.7-3.

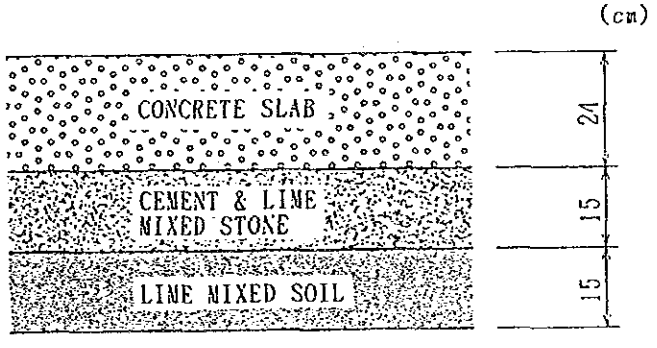


Fig.7-3 Pavement Structure of Roads and Carpark

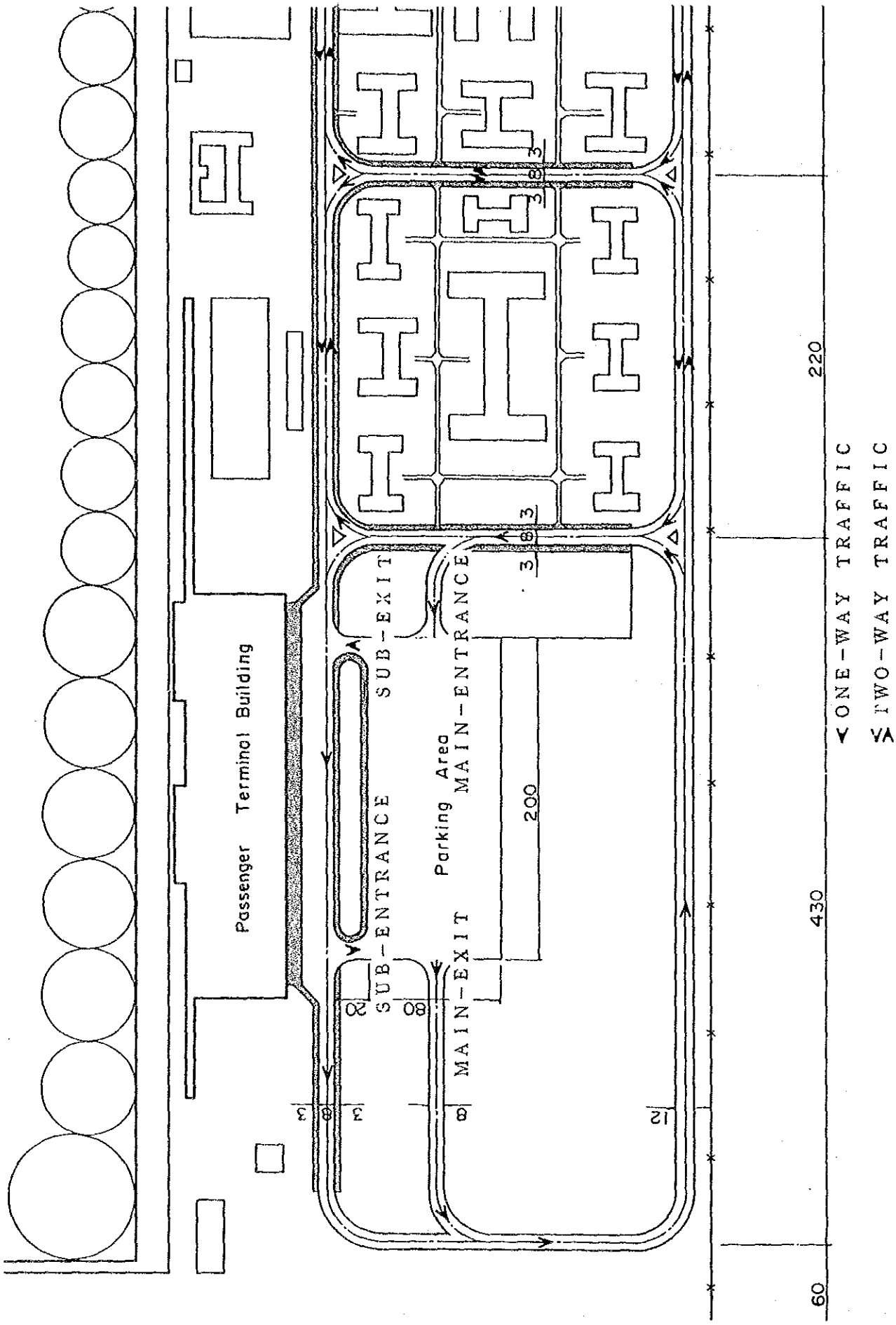


Fig. 7-4 Flow of Vehicles in Terminal Area

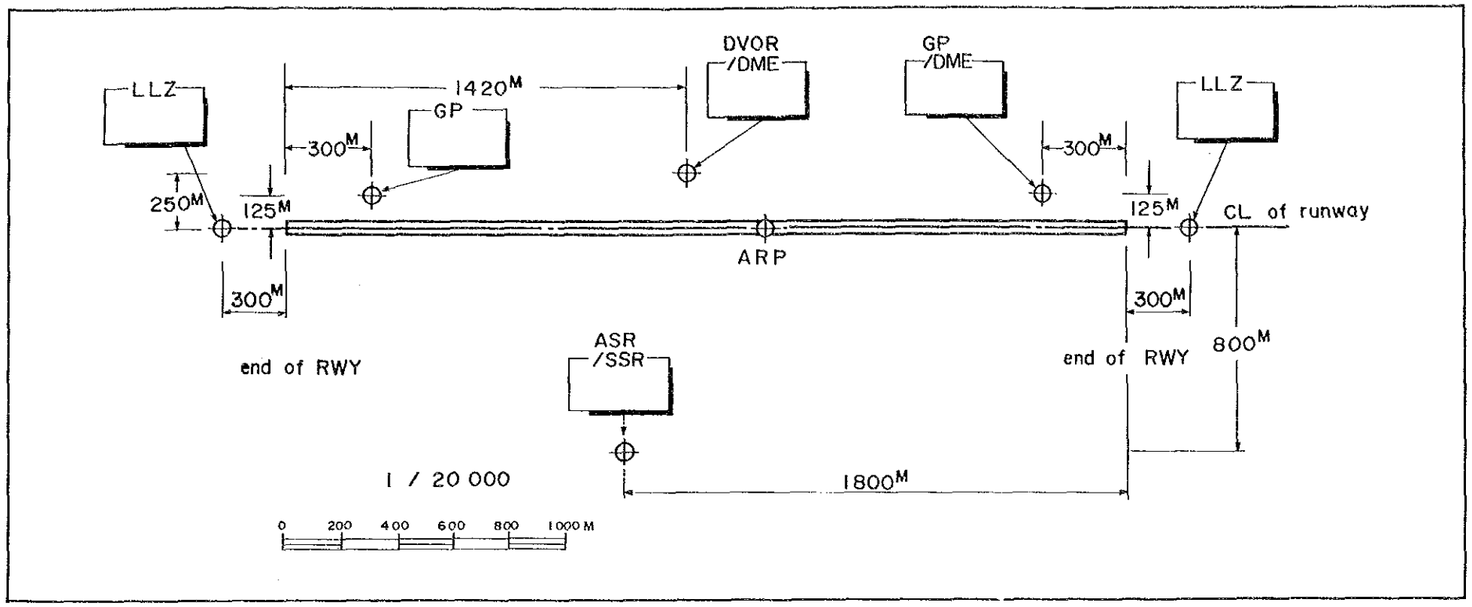
7.4 Air Navigation Facilities

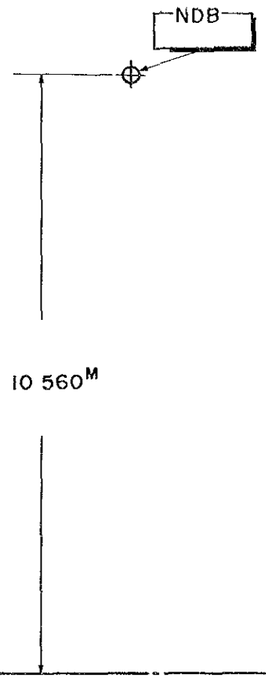
The preliminary design of the air navigation facilities is outlined hereunder, with the block diagrams and the layout plan of the air navigation facilities as shown in Appendices 7-6(1) and (3) respectively.

7.4.1 Radio Navigational Aids

The ILS planned for RWY 04 is to be provided with Category II precision approach aids, consisting of LLZ, GP, LMM, OM, remote control and monitoring unit. The ILS planned for RWY 22 is to be provided with Category I precision approach aids, comprising LLZ, GP/T-DME, LMM and remote control and monitoring unit. Interlocking systems for both ILSs are to be provided so as to prevent simultaneous propagation of each ILS radio wave.

Relative locations of the above radio navigational aids together with VOR/DME and two NDBs determined by CAAC are assesed as shown in Fig.7-5.





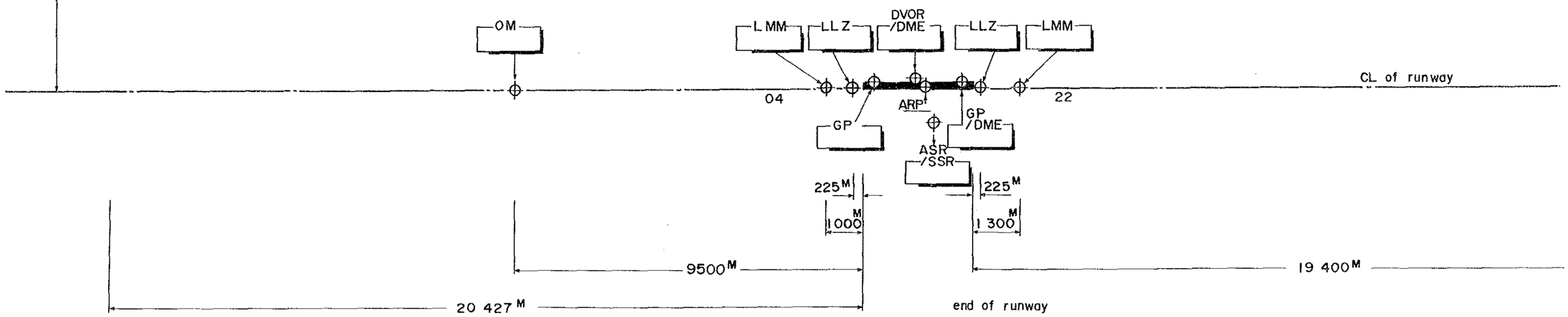
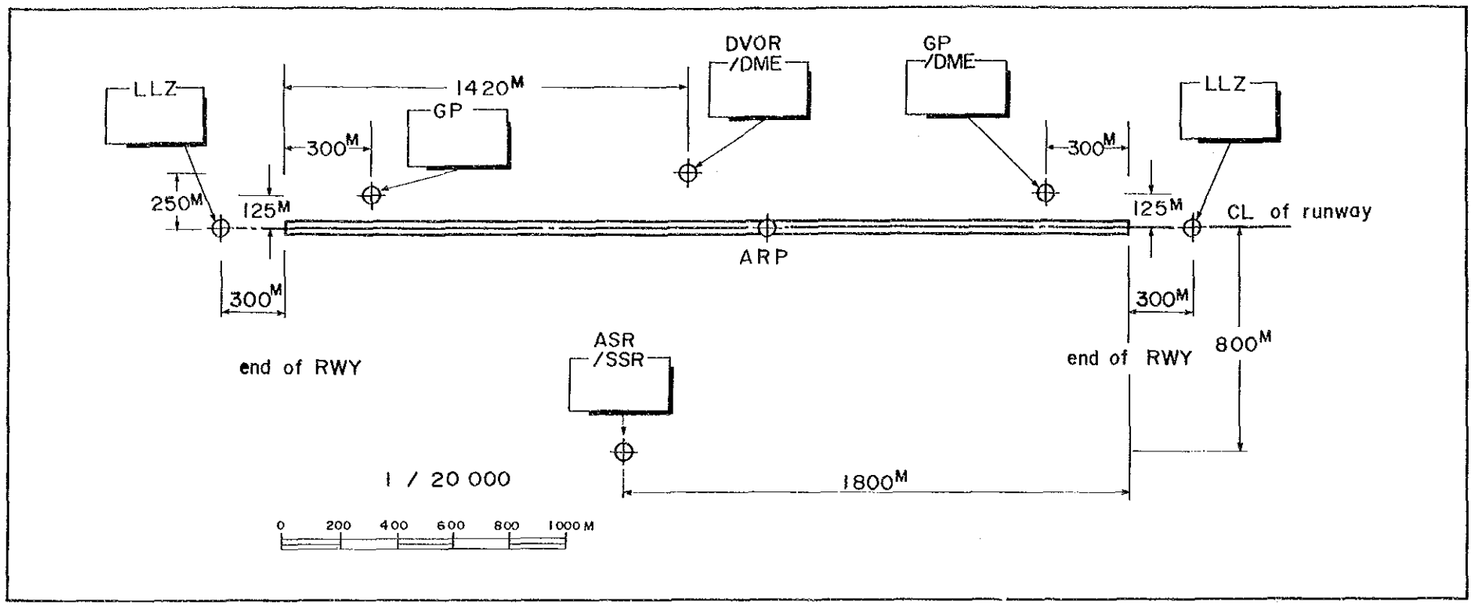


Fig.7-5 Allocation Pl



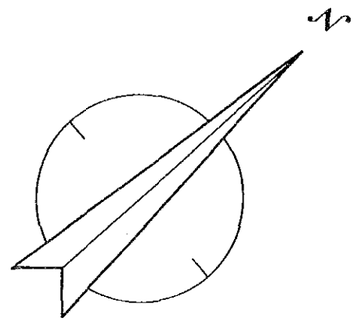


Fig.7-5 Allocation Plan of Radio Nav-aids

7.4.2 Visual Aids

Airfield lights and markings are designed based on ICAO Annex 14 standard and recommendations except 'Huan Shi Lights', supplemental approach lights, designed on the basis of Chinese standards, with the layout plan as shown in Appendix 7-6(3).

Electric power supply for airfield lights is drawn from the north substation and the south substation. Switching on/off and changing the brilliancy of lighting are controlled from a control desk for airfield lights installed in the control tower. Control and monitoring desks for airfield lights are also installed in the main substation for use in case of emergency or maintenance. A local control and monitoring desk is installed in the north and the south substations for maintenance. The diagram of the control system of the airfield lights is shown in Fig.7-6.

Electric power supply for apron flood lights is drawn from the passenger terminal building and the aircraft maintenance facility. A control desk for apron flood lights is installed in the main substation.

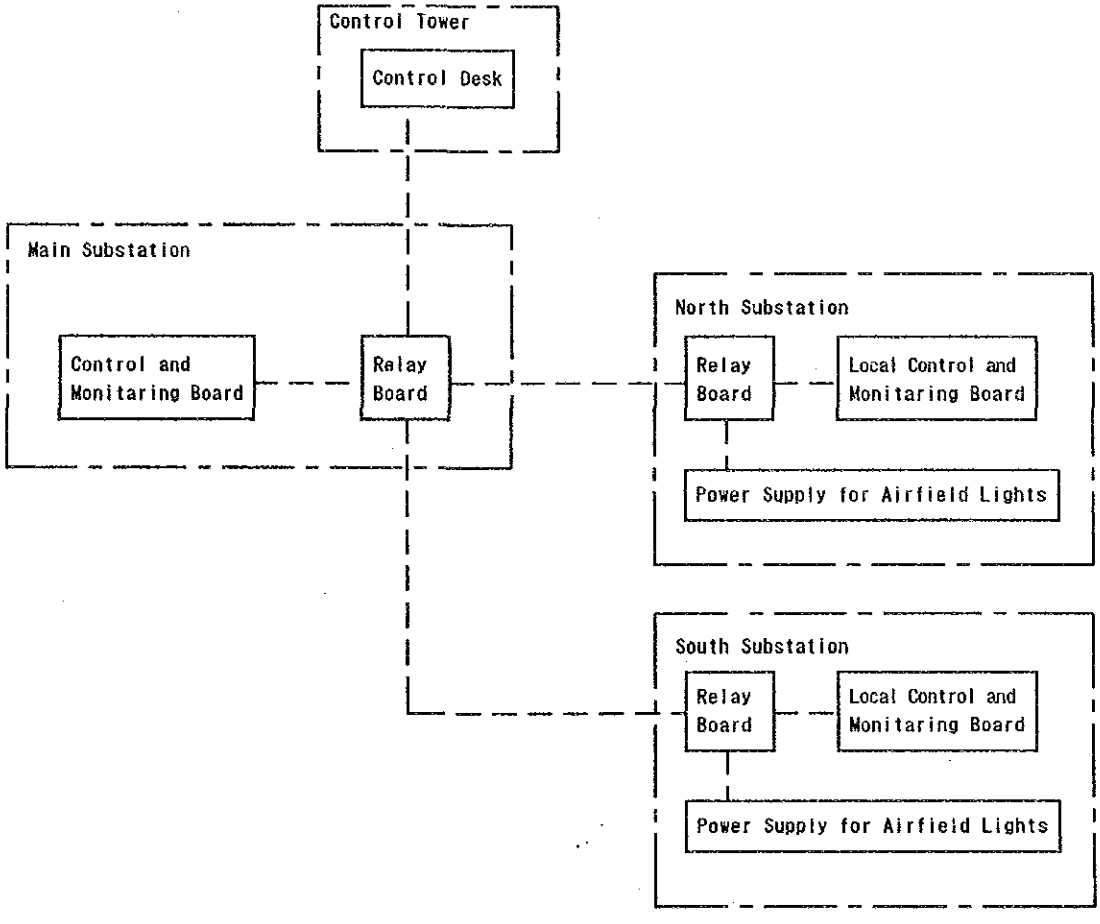


Fig.7-6 Control System of Airfield Lights

7.4.3 Air Traffic Control Facility

(1) Tianhe Control Tower

The control tower is planned as an eight-storied building with a tower shaft providing access to the control room by a stairway and an elevator. The floor space is planned amply but not excessively because air traffic controllers' viewing angles become more limited as it increases. A floor plan of the control tower based on ICAO standard models is shown in Fig.7-7

The design conditions for the control tower and its base building are determined as follows, with the floor plans and the elevations as shown in Appendis 7-7:

- Building area: 1,325 m^2
  - First floor area: 900 m^2
  - Second floor area: 1,000 m^2
  - Third floor area: 1,000 m^2
  - Fourth to Eighth floor area: 150 m^2
  - Total floor area: 3,050 m^2
- Structure : Four stories of reinforced concrete
- Exterior finishing
  - Roof: Flat roof with asphalt waterproofing and walkable clinker tile
  - Wall: Mosaic tile
  - Fittings: Aluminum sash
  - Windows and glass: Glass block and polished glass
- Interior finishing
  - Floor: Vinyl floor tile
  - Wall: Emulsion paint
  - Ceiling: Gypsum board
- Equipment: One elevator

(2) Combined Wuhan ACC and Tianhe Radar Approach Control Facility (IFR Room)

A combined facility of IFR room is planned in the base building, of which floor plan based on ICAO models as shown in Fig.7-7. The following radar displays are set in the room:

- Two vertical radar displays for en-route traffic control positions with co-ordinators' positions in the centre;
- Four vertical radar displays for approach/departure control positions with strip boards on each sides.

In the base building, the following rooms are also planned:

- Administrative offices;
- Training rooms;
- Conference rooms;
- A briefing/rest room;
- Locker rooms;
- Radar/radio equipment rooms;
- Automation equipment rooms;
- A recorder and playback room;
- Radar/radio maintenance rooms, etc.

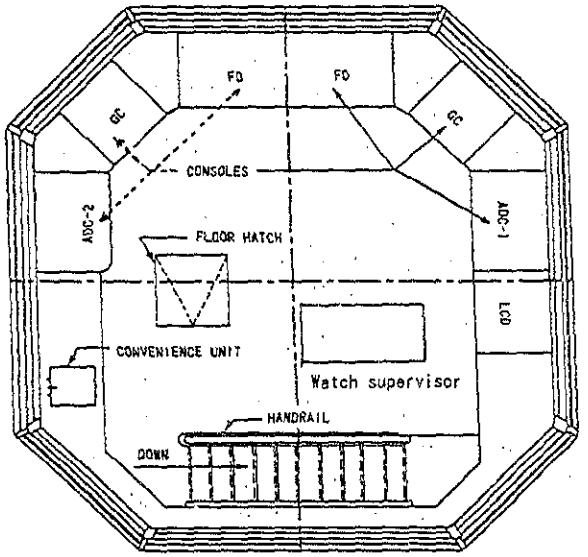
(3) Radar

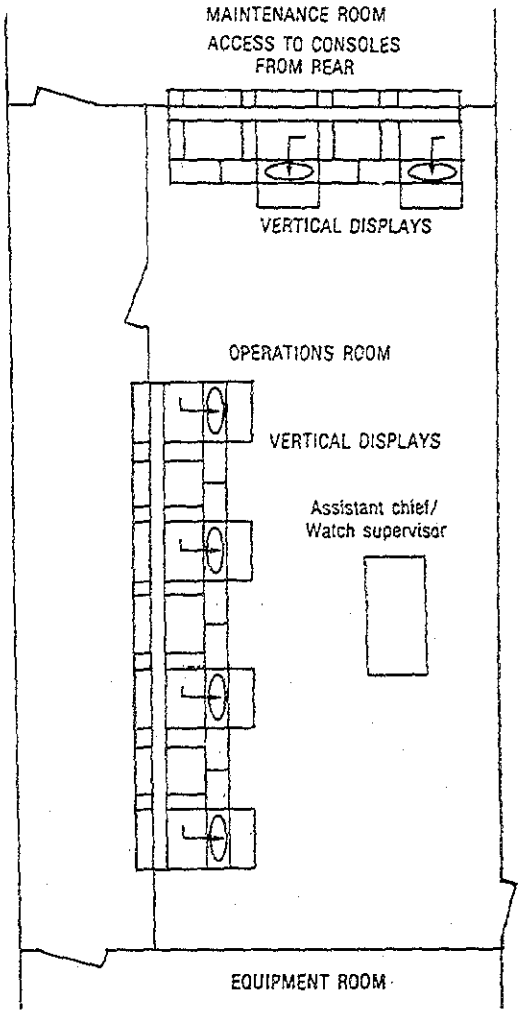
Airport Surveillance Radar (ASR)/Secondary Surveillance Radar (SSR) and Terminal Radar Data Processing System (TRDPS) are planned for radar approach control and Area Control Centre (ACC). The antenna site of ASR/SSR is to be located in the terminal area. The coverage of ASR is to be more than 65 NM for approach control and that of SSR more than 200 NM for enroute control.

(4) Communication Control Unit (CCU) and Consoles

CCU and consoles are planned as follows:

- CCU: more than 50 channels
- Consoles
  - Aerodrome control: in Tianhe Control Tower
  - Ground control: - ditto -
  - North ARR/DEP Control: in Tianhe Radar Approach Control Facility (IFR ROOM)
  - East ARR/DEP Control: - ditto -
  - South ARR/DEP Control: - ditto -
  - West ARR/DEP Control: - ditto -
  - ACC North Sector Control: in Wuhan ACC
  - ACC South Sector Control: - ditto -





Key to symbols
ADC = Aerodrome Control
GC = Ground Control
FD = Flight Data
LCD = Lighting Control Desk

Fig.7-7 A Sample Floor Layout Plan of Control Tower and ACC/Approach Control Facility

7.4.4 Aeronautical Telecommunications Facility

Teletypewriters are planned to connect with Guangzhou switching centre in AFTN communication lines. RTF is planned as the tool to communicate with local airports in Hubei Province. ATS direct speech circuits are planned to communicate with adjacent ACCs. The transmitter site is to be located beside the access road 3 km north of the Airport, and the receiver site 2 km south of the Airport.

Other equipment are shown in Table 7-2.

Table 7-2 Planned Telecommunications Equipment

Equipment	TX	RX
VHF:		
Ground Control	30 w dual	dual
Aerodrome Control	30 w dual	dual
North ARR/DEP Control	50 w dual	dual
East ARR/DEP Control	50 w dual	dual
South ARR/DEP Control	50 w dual	dual
West ARR/DEP Control	50 w dual	dual
Distress/Emergency	50 w dual	dual
ACC North Sector	50 w dual	dual
ACC South Sector	50 w dual	dual
ATIS	50 w dual	N/A
UHF:		
Distress/Emergency	50 w dual	dual
HF:		
AMS (SSB)	500 w (4 ch) dual	5 sets
RTF (SSB)		
West	500 w (4 ch) dual	5 sets
North West	250 w (4 ch) dual	5 sets
East	250 w (4 ch) dual	5 sets
VHF TRCV:		
VFR Room	3 ch 10 w dual	
IFR Room	5 ch 10 w dual	
VHF TRCV (FM):		
VFR Room	10 w dual	
Fire Commanding Room	10 w dual	
Fire Engine (Mobile)	5 w 5 sets	

7.4.5 Meteorological Facility

The meteorological facility is to be accommodated in the base building as described in Section 7.4.3 and the following meteorological observation instruments and related communication equipment are planned to be installed:

- Transmissometer and RVR Converter	2 sets
- RVR Indicator	3 sets
- Ceilometer	2 sets
- Anemometer/Wind vane	2 sets
- Wind Direction/Wind Speed Indicators	3 sets
- Barometer:	
- Mercury type (for calibration)	1 set
- Aneroid type (precision type)	1 set
- Barograph	1 set
- Thermometer/Hygrometer (Dew point Sensor) for both runways	2 sets
- Thermograph/Hygrograph (with shelter)	1 set
- Rainfall Gage (Precipitation Metre)	1 set
- Rain Sensor	1 set
- Weather Radar	1 set
- Data Collection Rack	1 set
- Radio and TTY:	
- TTY	1 set
- HFTX 5 ch 500 w	1 set
- HFRX 5 ch	1 set
- Radio FAX:	
- HFRX 5 ch	1 set
- FAX Recorder	1 set
- Satellite Receiver:	
- Satellite Receiver	1 set
- Picture Recorder	2 sets

7.5 Airport-Related Facilities

7.5.1 Drainage Facility

The rain water drainage facilities are designed based on the following conditions:

(1) Quantity of runoff

The quantity of runoff water is calculated according to the following formula:

$$Q = q \times \{(A_p \cdot C_p + A_b \cdot C_p + A_g \cdot C_g)$$

where,
Q: Quantity of runoff (l/s)
q: Rain fall intensity as defined below
C_p, C_b, C_g: Runoff coefficient as defined below
A_p: Paved area of catchment (ha)
A_b: Building area of catchment (ha)
A_g: Grass area of catchment (ha)

(2) Rain Fall Intensity

The rain fall intensity in Wuhan/Tianhe Airport is calculated according to the following formula:

$$q = \frac{983 \times (1 + 0.65 \log P)}{(t + 4)^{0.56}}$$

where,

q: Rain fall intensity (l/sec.per ha)
P: Design period (year)
t: Time of concentration (sec)
$t = t_1 + t_2$
t_1: Inlet time
t_2: Time of flow

(3) Design Period

The design period of 5 years is adopted on the basis of the FAA Advisory Circular saying that a maximum rainfall expected once in 5 years is generally recommended for estimating runoff for airports.

(4) Runoff Coefficient

Runoff coefficient is determined based on the Chinese Road Design Manual as follows:

- Paved area: $C_p = 0.9$
- Building area: $C_b = 0.9$
- Grass area: $C_g = 0.3$

(5) Division of Catchment Area

For the purpose of the calculation, the airport area is divided into small areas and measured as shown in Appendix 7-8(1).

(6) Drainage Facility Plan

Based on the above conditions, designs are made on routes of drainage facilities and sizes of pipes and channels as shown in Appendix 7-8(2).

7.5.2 Water Supply Facility

To comply with the estimated water capacity requirements, the following facilities are planned to be installed:

(1) Water Quantity

1) Peak day water supply volume: 2,400 m^3/day
2) Peak hour water supply volume: 125 m^3/hour

(2) Major Facilities

1) Intake system: Direct intake from Houfu Lake

2) Intake pump: 1.0 m^3/min. x 3 units
(including one spare)

3) Water treatment facility
a. System: Rapid sand filtration system with iron removal filter.
b. Treatment capacity: 2,904 m^3/day
c. Layout plan: as shown in Appendix 7-9.

4) Transmission pump: 0.92 m^3/min. x 3 units
(including one spare)

5) Airport water station
a. Reservoir: 680 m^3
b. Lift-up pump: 2.1 m^3/min. x 3 units
(including one spare)
c. Water tower: 200 m^3

7.5.3 Sewage Disposal Facility

(1) Sewage Treatment Facility

The layout plan of the sewage treatment facility is made as shown in Appendix 7-10 (1) based on the following design conditions.

1) Peak day waste water volume: 2,160 m^3/day

2) Peak hour waste water volume: 113 m^3/day

3) Sewage treatment facility
   a. Raw sewage: BOD 200 ppm , SS 250 ppm
   b. Effluent water: BOD 60 ppm , SS 200 ppm
   c. Treatment method: Standard activated sludge process

(2) Trash Disposal Facility

The layout plan of the trash disposal facility is made as shown in Appendix 7-10 (2) based on the following design conditions.

1) Peak day trash quantity: 15.8 t/day
2) Trash capacity to be treated by the incinerator: 7.9 t/day
3) Incinerator capacity to be installed
   : 0.5 t/h (8 hours operation) x 2 units

7.5.4 Electrical Facility

(1) Transmission and Distribution Lines

Electric power for the main station in the Airport is to be supplied in 35 kV transmission line by the two substations, Heng Dian Zhen substation and Chen Jia Ji substation both of which are supplied by Dai Jia Shan substation. The oil terminal is to be supplied with electric power by Heng Dian Zhen substation in 10 kV distribution line.

As regards TX facility, RX facility and Water Treatment Plant, the power is to be supplied by the main substation in the Airport in 10 kV distribution line. On the other hand, electric power for two NDBs and Outer Marker are to be supplied by the existing 10 kV distribution line nearby.

The routes of the transmission and the distribution lines are shown in Fig. 7-8, and the diagram of those in Appendix 7-11.

(2) Electric Power Facility

Electric power for the airport facilities is to be supplied by the main substation in the Airport in 10kV with tranformers as shown in Table 7-3. The simple diagram of the electric power supply system in the Airport is as shown in Appendix 7-6(2).

Table 7-3 Capacity of Transformers for Airport Facilities

Airport Facility	Capacity	Unit
Main Substation	10 MVA	2
Passenger Terminal Building	2 MVA	2
Control Tower and Meteorological Facility	200 kVA	1
Aircraft Maintenance Facility	1 MVA	1
Pilot and Crew Room	200 kVA	1
Airport Fuel Depot	800 kVA	1
Boiler Station	500 kVA	1
Staff Housing for Married Persons	500 kVA	1
ASR/SSR	100 kVA	1
Guard Facility	125 kVA	1
Canteens	200 kVA	1
North Substation	250 kVA	1
South Substation	315 kVA	1
Sewage Treatment	160 kVA	1
Cargo Terminal Building	125 kVA	1
GSE Facility	100 kVA	1
Common Storage	50 kVA	1
Airfield Administration Staff Grooming Room	125 kVA	1
Medical Check and Health Control Room	100 kVA	1
Welfare and Living Service	80 kVA	1
Catering Facility	200 kVA	1
Administration Building of Airport Authority	80 kVA	1
Administration Building of Airlines	80 kVA	1
Staff Accommodation	100 kVA	1

(3) Stand-by Engine Generators

Airport facilities to be equipped with stand-by generators are shown in Table 7-4.

Stand-by generators in the north and south substations are required to be capable of switching over within one second.

Table 7-4 Capacity of Stand-by Generators

Airport Facility	Capacity	Unit
Main Substation	50 kVA	1
Passenger Terminal Building	500 kVA	1
Control Tower and Meteorological Facility (include apron flood lights)	500 kVA	1
Aircraft Maintenance Facility (for apron flood light)	50 kVA	1
ASR/SSR	75 kVA	1
Airport Fuel Depot	500 kVA	1
North Substation	250 kVA	1
South Substation	300 kVA	1
Oil Terminal	125 kVA	1
Water Treatment Plant	160 kVA	1
TX Site	75 kVA	1
RX Site	20 kVA	1
North NDB	20 kVA	1
South NDB	20 kVA	1
RWY04 Outer Marker	2 kVA	1

(4) Telephone System

Optical fiber cable routes of 300 channels and microwave routes of 60 channels are planned for telephone lines between the telephone station in Wuhan City and the Airport, with the routes plan as shown in Fig. 7-9.

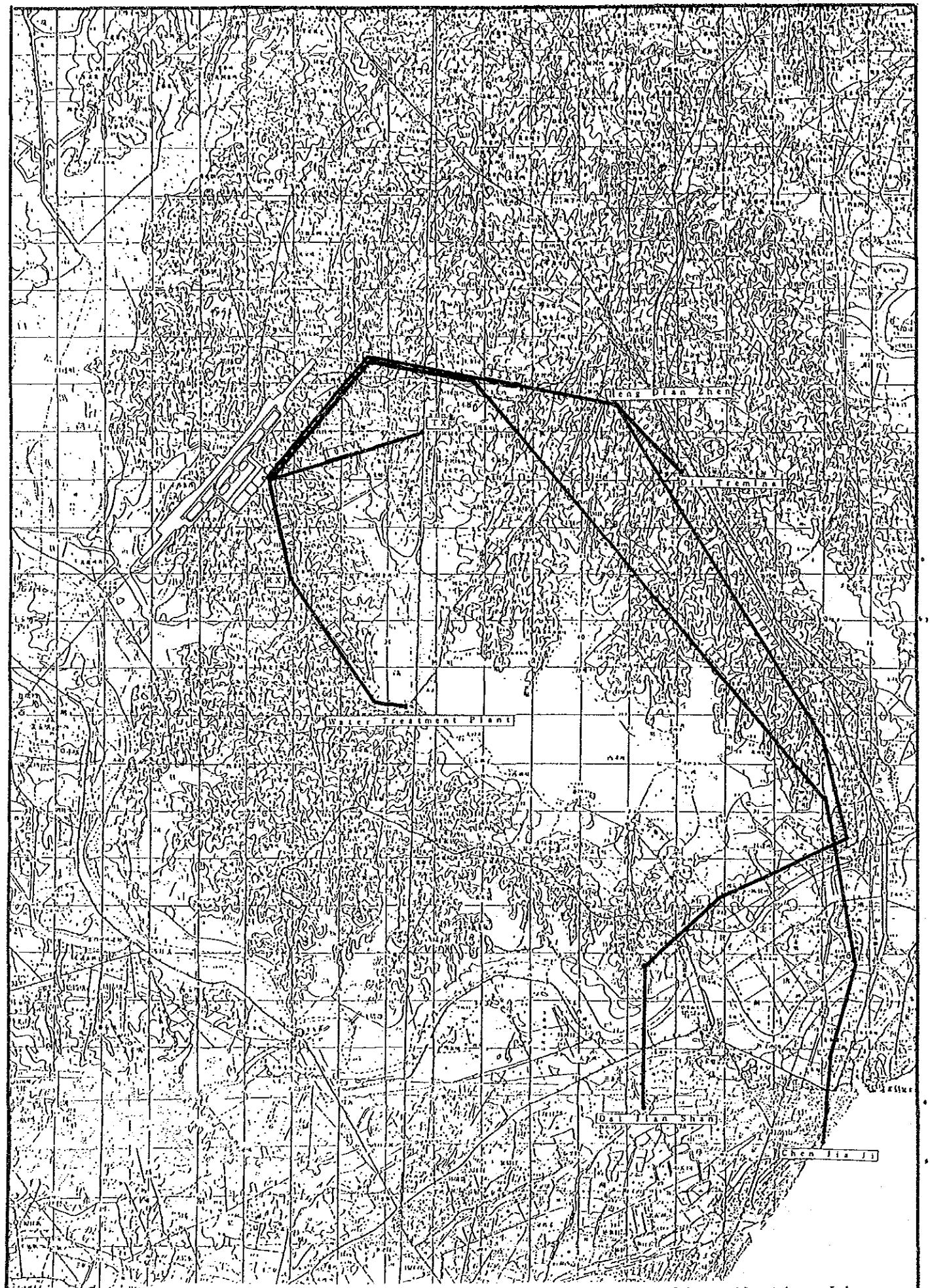


Fig.7-8 Route of the Transmission and the Distribution Lines

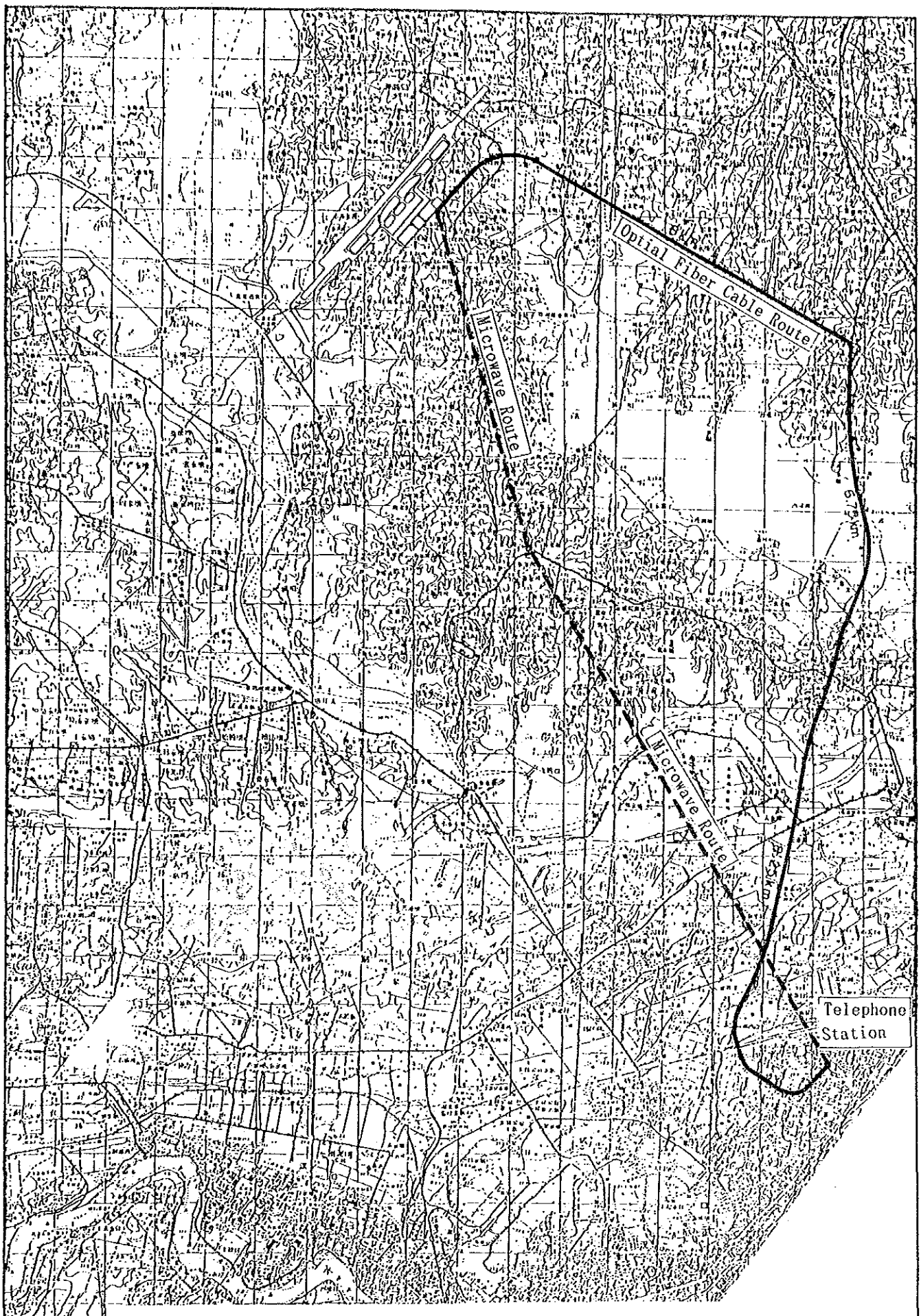


Fig.7-9 Route of the Optical Fiber Cable and the Microwave

7.5.5 Fuel Supply Facility

(1) Aircraft Fuel Facility

1) Oil Terminal

a. Fuel reception

The total jet fuel unloading from one train of railway tank cars is determined as follows:

45 kl/tank car x 48 tank cars = 2,160 kl

Four units of unloading pumps for jet fuel are to be installed, each of which is to cover 12 tank cars, and one unit for each of the other fuel and oil.

b. Fuel storage

Two cone roof tanks each having storage capacity of 2,000 kl for RP-2 are installed to sufficiently accommodate the total quantity of jet fuel as determined above. The tanks and pipes for lubricating oil of HH-20 and HP-8 require a heating system with a coal boiler and thermal insulation device. As regards the unloading works from railway tank cars, these two grades of lubricating oil can be unloaded through the bottom valves of tank cars, while the other grades of fuel and oil must be unloaded through overhead unloading arms.

The required capacity and number of tanks and pumps for other grades of fuel and oil are as shown in Appendix 7-12(1), (2).

c. Fuel transfer pipeline

One pipeline with the width of 10 inch and the approximate length of 9 km is planned to be buried along the shoulder of the access road to the Airport which is to be diverged from Dai Huang Road near Hengdian Railway Station. The underground pipe is to be protected against corrosion with cathodic protection device. Two units of transfer pumps with a capacity of 200 kl each are to be installed in the pipeline, including one for reserve.

The other six grades of fuel and oil are to be transported to the Airport by tank trucks comprising six fuel loading units and pumps with the capacity of approximately 70 kl/h each.

d. Appurtenant facilities

The following appurtenant facilities are required:

- Fire fighting system:
  Airfoam fire fighting facilities by means of bottom injection system, and sprinkler system for the main storage tanks.
- Electric power generating unit with required capacity.
- Fuel drain tanks (slop tanks):
  50 kl x 2 units for RP-2; and
  20 kl x 1 unit for RH95/130.

2) Airport Fuel Depot

a. Fuel storage

Four storage tanks of 5,000 kl standard size are to be installed to comply with CAAC regulation specifying a minimum aircraft fuel stock of more than 60 days consumption at airports. The capacity and number of tanks for other grades of fuel and oil are as shown in Appendix 7-12(3), (4).

b. Hydrant fueling system

Hydrant service pumps are designed to be automatically controlled at all times so as to meet any demand for rates of flow and pressure required by aircraft type. However, an auto-manual changeover system is also to be provided in case of emergency.

One pair of hydrant valve and pit is to be installed in each of 13 aircraft fueling berths on the apron (excluding night stay spots), so that fueling to either of two wings of aircraft is available. A dual hydrant service piping system is designed to ensure further trouble-free fueling operations by offering "looping" on the apron. All the buried pipes are to be protected against corrosion with cathodic protection device.

c. Appurtenant facilities

The major appurtenant facilities are as follows:

- Flow meter calibration service facilities consisting of the master meter system and the prover tank system.
- Facilities for loading fuel into refuelers.
- A testing farm for hydrant fueling dispensers where actual aircraft fueling operations can be simulated.
- Facilities for transfer piping and pumping of fuel in storage tanks into slop tanks for periodical quality checks.
- Fire fighting and sprinkler systems as required by Chinese Fire Fighting Service Law.
- Electric power generating units.
- Mobile equipment as follows:
  - Hydrant fueling dispensers x 4 units
  - Vacuum car x 1 unit

(2) LPG Supply Facilities

In accordance with the CAAC regulation, required stock of LPG is as follows:

1,600 kg (daily consumption) x 60 days = 96,000 kg

In addition, five horizontal cylindrical tanks of 20 tons and three units of pumps for unloading and loading of LPG are planned to be installed.

7.5.6 Air-conditioning Facility

Central heating source is planned as follows with the layout plan as shown in Appendix 7-13:

a. Heating source capacity: 9,375,000 kcal/hour
b. Heating source equipment: Hot water boiler with coal burner
c. Boiler capacity: 2,400,000 kcal/hour x 4 units

On the other hand, cooling source for each building is planned to be provided by individual system as described in Section 5.5.6 of Chapter 5.

7.5.7 Rescue and Fire-fighting Facility

The design conditions for the rescue and fire-fighting facility are determined in the following, with the floor plan as shown in Appendix 7-14(1):

a. Building area: 700 m^2
   - First floor: 700 m^2
   - Second floor: 700 m^2
   - Third floor: 100 m^2
   - Total floor area: 1,500 m^2

b. Structure: Three stories of reinforced concrete

c. Exterior finishing
   - Roof: Asphalt waterproofing, unwalkable
   - Wall: Mosaic tile
   - Fittings: Aluminum sash

d. Interior finishing
   - Garage floor: Concrete with trowel and hardener
   - Office floor: Vinyl floor tile
   - Wall: Mortar with emulsion paint
   - Ceiling: Gypsum board

e. Vehicles: six rescue and fire-fighting vehicles are equipped

7.5.8 Guard Facility

The design conditions of the guard facility are determined as follows:

a. Structure: Three stories of reinforced concrete including canteens.

b. Exterior finishing
   - Roof: Flat roof of walkable clinker tile with asphalt water proofing.
   - Wall: Mosaic tile
   - Fittings: Aluminum sash

c. Interior finishing
   - Floor: Vinyl floor tile
   - Wall: Mortar with emulsion paint
   - Ceiling: Gypsum board

7.5.9 Related Buildings

The design conditions of related buildings are determined in the following, with the floor plans of major buildings of Administration Buildings of Airport Authority(A/A) and Airlines (A/L), Catering Facility, Downtown Staff Housing, and Downtown Ticketing Office as shown in Appendix 7-14(1) to (8):

a. Exterior finishing
   - Roof: Asphalt waterproofing, unwalkable
   - Wall: Exposed concrete finish with acrylic-urethane resin paint
   - Fittings: Aluminum sash

b. Interior finishing
   - Floor: Vinyl floor tile and concrete with trowel and hardener
   - Wall: Mortar with emulsion paint
   - Ceiling: Gypsum board
   - Structure and floor areas: As shown in Table 7-5.

Table 7-5 Structure and Floor Area of Related Buildings

Facility	Structure	Stories	Floor Area (m^2)
Administration Building (A/A)	RC	4	2,000
Administration Building (A/L)	RC	4	2,000
Catering Facility	RC	1	2,000
Storage for Cabin Accessories	RC	1	800
Common Storage	RC	1	2,000
Airfield Administration Staff's Waiting Building	RC	2	2,000
Storage for Building Materials	RC	1	500
Pilot and Crew Facility	RC	3	3,000
Canteens for Airport Authority(A/A)	RC	1	1,500
Canteens for Airlines(A/L)	RC	1	1,500
Staff Housing for Married Persons	RC	6	19,000
Staff Housing for Unmarried Persons	RC	3	1,500
Clinic/Medical Office/Medical Check and Health Control Building	RC	2	1,300
Welfare and Living Service	RC	1	2,000
Electric Division of Service	RC	1	
Culture Centre	RC	1	
Public Bathhouse	RC	1	
Public Nursery and Kindergarten	RC	1	1,500
Staff Accommodations	RC	3	1,500
Airport Fuel Depot and LPG Station	RC	1	800
Main Substation	RC	1	1,000
Telephone Service Station	RC	1	500
Airport Water Supply Station	RC	1	500
Boiler Station	RC	1	900
Sewage Treatment/Sewage Disposal/Trash Disposal	RC	1	150
North/South Substations	RC	1	800
LLZ/GS/LMM/OM Substations for RWY04 side	RC	1	122
LLZ/GS·T-DME/LMM Substations for RWY22 side	RC	1	120
VOR·DME/04NDB/22NDB/Transmitter /Receiver/Weather Radar/Micro-wave Transmitting Substations and ATC Facilities	RC	1	1,017
Downtown Staff Housing	RC	5	36,000
Downtown Ticketing Office	RC	5	6,000